STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

ECP2036 – MICROPROCESSOR SYSTEMS AND INTERFACING
(ME)

2 JUNE 2017
3.00 p.m. - 5.00 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 7 pages with 5 questions only.

2. Attempt **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided.

Question 1

a) With the help of diagrams; describe the sequence of steps that took place between CPU and memory during memory read operation.

(12 marks)

b) In your own words explain the significance of the following instruction:

MOV SP, #4FH

(4 marks)

c) Identify and explain the functions of the following pins:
   a. Pin 20
   b. Pin 40

(4 marks)

Question 2

a) Complete the following table;

Address	Machine Code	Instruction
0B00		MOV A, #01H
		MOV R2, #0BH
		ADD A, R2
		ANL A, #12H
		MOVC A, @A+DPTR

(10 marks)

b) Rewrite the following machine code into its assembly language program

Address	Machine Code
0000	74 72
0002	75 F0 02
0005	95 F0
0007	70 02
0009	45 F0

(Note: Address for Accumulator is at E0H and register B is at F0H)

(10 marks)

Continued ...

Question 3

a) List any two of the 8051's serial port modes, how they are selected and their corresponding baud rate.

(6 marks)

b) Describe and illustrate the output of the following program:

```
        ORG 0100H
LOOP:SETB  P1.0
        NOP
        NOP
        CLR   P1.0
        SJMP  LOOP
        END
```

(4 marks)

c) Write a program that writes the value 55H to port 2 and creates a high to low pulse at P3.2 once P1.4 is high.

(10 marks)

Question 4

a) Design a door security system as in Figure 4.1 using interrupts that sound a loudspeaker with 400Hz tone for 1 second whenever the door sensor makes a high to low transition. The loudspeaker is connected to P2.1 and the sensor is connected to $\overline{INT0}$.

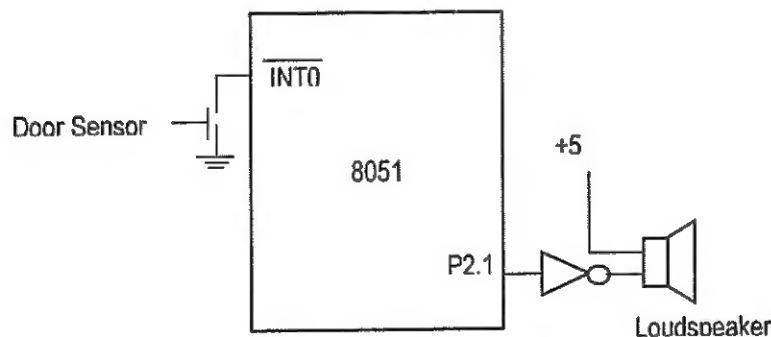Figure 4.1: Door Security System

(15 marks)

b) List the five interrupt sources of 8051

(5 marks)

Continued …

Question 5

An 8051 microcontroller is interfaced to an LCD.

a) Write the program to display "A+" with checking busy flag of the LCD.

(15 marks)

b) Draw the configuration of the system.

(5 marks)

Continued ...

Appendix A
Opcode Map

Opcode map (rows = low nibble, columns = high nibble F→0):

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0	MOVX @DPTR,A	MOVX A,@DPTR	POP dir	PUSH dir	ANL C,/bit	ORL C,/bit	MOV DPTR,#data16	SJMP rel	JNZ rel	JZ rel	JNC rel	JC rel	JNB bit,rel	JB bit,rel	JBC bit,rel	NOP
1	ACALL (P7)	AJMP (P7)	ACALL (P6)	AJMP (P6)	ACALL (P5)	AJMP (P5)	ACALL (P4)	AJMP (P4)	ACALL (P3)	AJMP (P3)	ACALL (P2)	AJMP (P2)	ACALL (P1)	AJMP (P1)	ACALL (P0)	AJMP (P0)
2	MOVX @R0,A	MOVX A,@R0	SETB bit	CLR bit	CPL bit	MOV C,bit	MOV bit,C	ANL C,bit	ORL C,bit	XRL dir,A	ANL dir,A	ORL dir,A	RETI	RET	LCALL addr16	LJMP addr16
3	MOVX @R1,A	MOVX A,@R1	SETB C	CLR C	CPL C	INC DPTR	MOVC A,@A+DPTR	MOVC A,@A+PC	JMP @A+DPTR	XRL dir,#data	ANL dir,#data	ORL dir,#data	RLC A	RL A	RRC A	RR A
4	CPL A	CLR A	DA A	SWAP A	CJNE A,#data,rel	MUL AB	SUBB A,#data	DIV AB	MOV A,#data	XRL A,#data	ANL A,#data	ORL A,#data	ADDC A,#data	ADD A,#data	DEC A	INC A
5	MOV dir,A	MOV A,dir	DJNZ dir,rel	XCH A,dir	CJNE A,dir,rel	*(reserved)*	SUBB A,dir	MOV dir,dir	MOV dir,#data	XRL A,dir	ANL A,dir	ORL A,dir	ADDC A,dir	ADD A,dir	DEC dir	INC dir
6	MOV @R0,A	MOV A,@R0	XCHD A,@R0	XCH A,@R0	CJNE @R0,#data,rel	MOV @R0,dir	SUBB A,@R0	MOV dir,@R0	MOV @R0,#data	XRL A,@R0	ANL A,@R0	ORL A,@R0	ADDC A,@R0	ADD A,@R0	DEC @R0	INC @R0
7	MOV @R1,A	MOV A,@R1	XCHD A,@R1	XCH A,@R1	CJNE @R1,#data,rel	MOV @R1,dir	SUBB A,@R1	MOV dir,@R1	MOV @R1,#data	XRL A,@R1	ANL A,@R1	ORL A,@R1	ADDC A,@R1	ADD A,@R1	DEC @R1	INC @R1
8	MOV R0,A	MOV A,R0	DJNZ R0,rel	XCH A,R0	CJNE R0,#data,rel	MOV R0,dir	SUBB A,R0	MOV dir,R0	MOV R0,#data	XRL A,R0	ANL A,R0	ORL A,R0	ADDC A,R0	ADD A,R0	DEC R0	INC R0
9	MOV R1,A	MOV A,R1	DJNZ R1,rel	XCH A,R1	CJNE R1,#data,rel	MOV R1,dir	SUBB A,R1	MOV dir,R1	MOV R1,#data	XRL A,R1	ANL A,R1	ORL A,R1	ADDC A,R1	ADD A,R1	DEC R1	INC R1
A	MOV R2,A	MOV A,R2	DJNZ R2,rel	XCH A,R2	CJNE R2,#data,rel	MOV R2,dir	SUBB A,R2	MOV dir,R2	MOV R2,#data	XRL A,R2	ANL A,R2	ORL A,R2	ADDC A,R2	ADD A,R2	DEC R2	INC R2
B	MOV R3,A	MOV A,R3	DJNZ R3,rel	XCH A,R3	CJNE R3,#data,rel	MOV R3,dir	SUBB A,R3	MOV dir,R3	MOV R3,#data	XRL A,R3	ANL A,R3	ORL A,R3	ADDC A,R3	ADD A,R3	DEC R3	INC R3
C	MOV R4,A	MOV A,R4	DJNZ R4,rel	XCH A,R4	CJNE R4,#data,rel	MOV R4,dir	SUBB A,R4	MOV dir,R4	MOV R4,#data	XRL A,R4	ANL A,R4	ORL A,R4	ADDC A,R4	ADD A,R4	DEC R4	INC R4
D	MOV R5,A	MOV A,R5	DJNZ R5,rel	XCH A,R5	CJNE R5,#data,rel	MOV R5,dir	SUBB A,R5	MOV dir,R5	MOV R5,#data	XRL A,R5	ANL A,R5	ORL A,R5	ADDC A,R5	ADD A,R5	DEC R5	INC R5
E	MOV R6,A	MOV A,R6	DJNZ R6,rel	XCH A,R6	CJNE R6,#data,rel	MOV R6,dir	SUBB A,R6	MOV dir,R6	MOV R6,#data	XRL A,R6	ANL A,R6	ORL A,R6	ADDC A,R6	ADD A,R6	DEC R6	INC R6
F	MOV R7,A	MOV A,R7	DJNZ R7,rel	XCH A,R7	CJNE R7,#data,rel	MOV R7,dir	SUBB A,R7	MOV dir,R7	MOV R7,#data	XRL A,R7	ANL A,R7	ORL A,R7	ADDC A,R7	ADD A,R7	DEC R7	INC R7

The 8051 Cookbook: A Comprehensive Guide to Architecture, Programming and Interfacing, 2nd Edition

Continued ...

Appendix B
Special Function Registers

TMOD (TIMER MODE REGISTER):

7	6	5	4	3	2	1	0
GATE	C/$\overline{\text{T}}$	M1	M0	GATE	C/$\overline{\text{T}}$	M1	M0

TCON (TIMER/COUNTER CONTROL REGISTER):

7	6	5	4	3	2	1	0
TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

SCON (SERIAL PORT CONTROL REGISTER):

7	6	5	4	3	2	1	0
SM0	SM1	SM2	REN	TB8	RB8	TI	RI

IE (INTERRUPT ENABLE REGISTER):

7	6	5	4	3	2	1	0
EA	-	ET2	ES	ET1	EX1	ET0	EX0

IP (INTERRUPT PRIORITY REGISTER):

7	6	5	4	3	2	1	0
-	-	PT2	PS	PT1	PX1	PT0	PX0

T2CON (TIMER/COUNTER CONTROL REGISTER)::

7	6	5	4	3	2	1	0
TF2	EXF2	RCLK	TCLK	EXEN2	TR2	C/$\overline{\text{T2}}$	CP/$\overline{\text{RL2}}$

PSW (PROGRAM STATUS WORD):

7	6	5	4	3	2	1	0
CY	AC	F0	RS1	RS0	OV	-	P

Continued ...

Appendix C
LCD Command Codes

Code (Hex)	Command to LCD
01	Clear display screen
02	Return home
04	Decrement cursor (shift cursor to left)
06	Increment cursor (shift cursor to right)
05	Shift display right
07	Shift display left
08	Display off, cursor off
0A	Display off, cursor on
0C	Display on, cursor off
0E	Display on, cursor blinking
0F	Display off, cursor blinking
10	Shift cursor position to left
14	Shift cursor position to right
18	Shift the entire display to left
1C	Shift the entire display to right
80	Force cursor to beginning of 1st line
C0	Force cursor to beginning of 2nd line
38	2 lines and 5x7 matrix

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